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(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENT- UND MARKENAMT

(12) **Patentschrift**

(10) **DE 198 12 288 C1**

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(56) Für die Beurteilung der Patentfähigkeit in Betracht gezogene Druckschriften:
DE 196 35 734 A1
DE 42 27 393 A1

(54) Hohlprofil mit Innenverstärkung und Verfahren zur Herstellung dieses Hohlprofils

(57) Bei Hohlprofilen mit Innenverstärkung, insbesondere zur Verwendung bei Automobilkarossen, soll ein Kernvolumennutzvolumen in alle Bereiche gelangen und ohne Gewichtserhöhung und ohne Querschnittsvergrößerung eine Hohlraumfüllung erreicht werden. Hierzu ist ein festes Kernmaterial mit einem aktivierbaren Material beschichtet und ein Außenmantel unter Bildung eines durch den Schäumvorgang des aktivierbaren Materials ausführbaren Hohlraums angeordnet, wobei die Größe des Hohlraums durch die Anordnung von Abstandshaltern je nach Anwendungsfall vorgegeben ist. Das feste Kernmaterial ist aus einem gasschäumbaren oder ungeschäumten metallischen Werkstoff oder aus einem mit Metallfasern, Kohlefasern oder Glasfasern verstärkten synthetischen Werkstoff gebildet.

DE 198 12 288 C1

DE 198 12 288 C1

Beschreibung

Die Erfindung betrifft ein Hohlprofil mit Innenverstiefung, insbesondere zur Verwendung bei Automobilkarossen.

In Maschinenbau und auch insbesondere im Automobilbau werden gezogene und verformte Blechprofile zweckmäßig miteinander verschweißt. Für die sich hierdurch einstellenden Hohlprofile lassen sich zunehmende Widerstandsmomente und Biegesteifigkeiten nur erreichen, indem die Blechquerschnitte entsprechend vergrößert oder die Blechwandstärke erhöht wird. Eine Vergrößerung der Querschnitte führt besonders bei Strukturbauteilen zu einer Verringerung der inneren oder äußeren Abmaße, und eine Erhöhung der Wandstärke zu einem nicht gewünschten Mehrgewicht. Für eine Verstärkung von Hohlprofilen besteht außerdem die Möglichkeit, diese mit Rippenprofilen zu versehen. Bei Hohlprofilen, die vorwiegend einen Korrosionsschutz erhalten sollen, sind Rippenprofile jedoch ungeeignet, wenn eine gewünschte Schutzwirkung, wie bei Automobilkarossen üblich, im Tauchverfahren erzeugt wird, da die Rippenprofile verhindern, daß das Korrosionsschutzmittel in alle Bereiche der Innenprofile gelangen oder nicht gewünschte Taschen bilden.

Aus DE 42 27 393 A1 soll eine Verringerung der Korrosionsanfälligkeit des Metalls des Hohlkörpers im Bereich des von diesem umschlossenen Raums erreicht werden. Hierzu wird u. a. eine elektrisch leitende Schicht aus einem Opfermetall oder aus einer Folie eingelegt, wobei diese Schicht durch einen Aufschlußvorgang eines den Raum umgrenzenden Materials zur Auflage auf der Innenfläche des Hohlkörpers gebracht werden soll. Aus dieser Schrift kann kein Hinweis darauf entnommen werden, wie eine zur Aufnahme von Kälte geeignete Innenverstiefung bei Hohlprofilen erreichbar ist.

Das Ausschlämmen von Hohlräumen zur Verbesserung der

die Beschichtung des mit dem aktivierbaren Material versehenen festen Konstruktionsmaterials niedriger gehalten als die Einbrennemperatur für die Korrosionsschicht im Trockenofen. In weiterer Ausgestaltung der Erfindung wird zielgerichtet im Trockenofen infolge der höheren Temperatur eine Reaktion des aktivierbaren Materials ausgelöst und durch das sich dabei bildenden Schaum der ursprünglich gewählte vorgesehene Hohlraum zwischen dem aktivierbaren Material und dem Außenblech ausgefüllt.

Ein Ausführungsbeispiel der Erfindung ist in der Zeichnung dargestellt und wird nachfolgend näher beschrieben. Es zeigen:

Fig. 1 eine schematische Darstellung eines Hohlprofils vor der Ausschäumung,

Fig. 2 wie Fig. 1, jedoch nach der Ausschäumung,

Fig. 3 wie Fig. 1, jedoch mit festem Korrosionsmaterial in Form eines festen Profilkörpers mit Hohlraum und

Fig. 4a bis 4d Varianten von Profilen mit schaumfähigem Material beschichtet.

Das feste Korrosionsmaterial 1 ist mit einem aktivierbaren Material 2 beschichtet. Unter Bildung eines Hohlraums 3 ist ein Außenblech 4 angeordnet. Der Hohlraum 3 wird durch den Schlitzdurchgang des aktivierbaren Materials 2 voll ausgefüllt. Je nach Anwendungsfall wird die Größe des Hohlraums 3 vorbestimmt. Hierzu [illegible] nach Fig. 1 ist ein [illegible] Korrosionsmaterial 1, durch das beispielhaft Hohlprofil 6 gebildet.

Vor dem Schlitzdurchgang wird das Hohlprofil 6 einem Korrosionsschutz-Tauchbad zugeführt. Da die Innenseite des Außenbleches 4 in diesem Zustand noch frei zugänglich ist, kann das Korrosionsschutzmittel in alle Bereiche des Innenprofils gelangen. Die Beschichtung des Korrosionsmaterials 1 erfolgt bei einer Temperatur, die niedriger ist als die Einbrennemperatur für die aufgebrachte Korrosionsschicht im Trockenofen. Diese höhere Temperatur im Trockenofen führt zu einer Reaktion des Beschichtungsmaterials, wo-

Nummer: DE 198 12 [illegible] C1
Int. Cl.: F16S [illegible]
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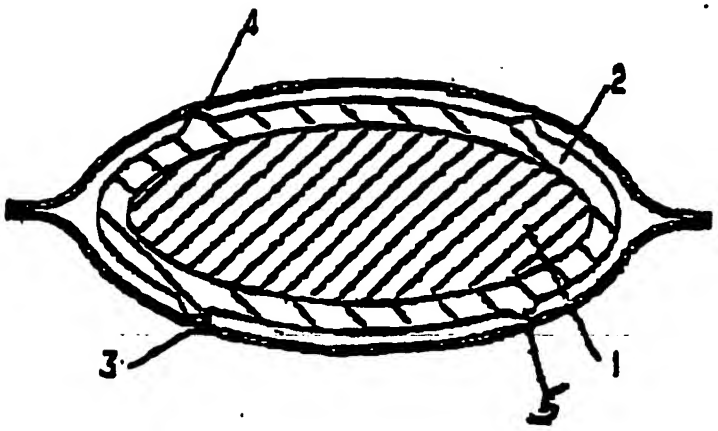

Fig. 1

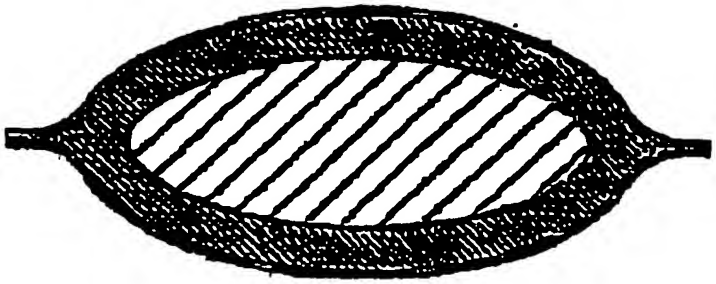

Fig. 2

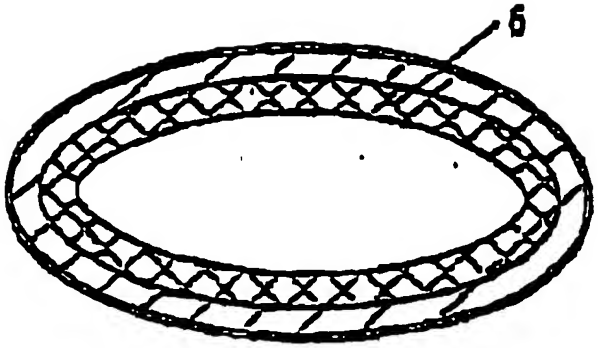

Fig. 3

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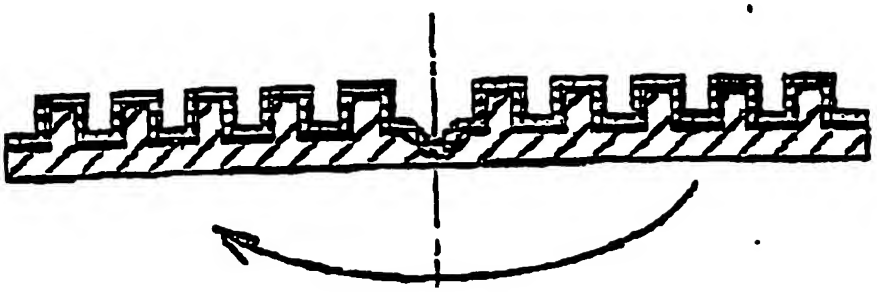

Fig. 4a

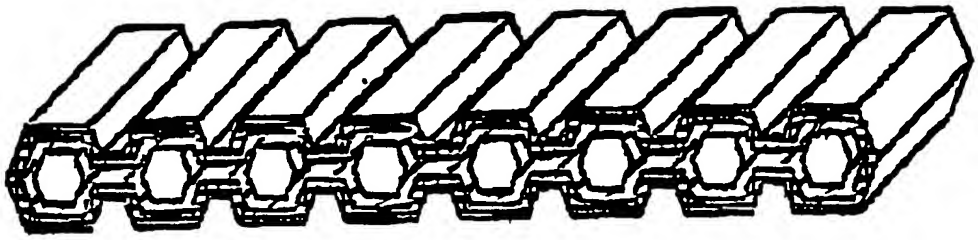

Fig. 4b

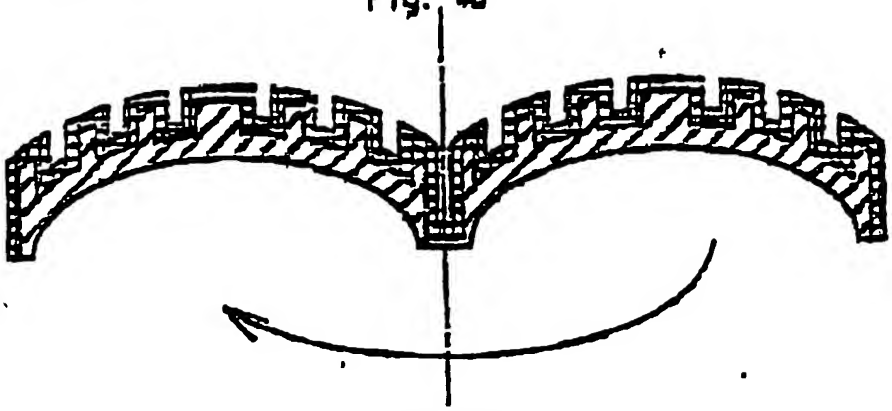

Fig. 4c

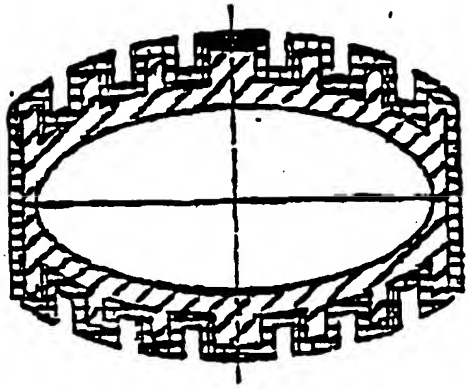

Fig. 4d

durch gekennzeichnet, daß das feste Kernmaterial (1) nur in Teilbereichen mit dem aktivierbaren Material (2) beschichtet ist.

5. Verfahren zur Herstellung eines Hohlprofils mit Innenversteifung, insbesondere zur Verwendung bei Automobilkarossen, nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß das Hohlprofil vor dem Schäumvorgang des aktivierbaren Materials (2) einem Korrosionsschutz-Tauchbad zugeführt wird und dabei das Korrosionsschutzmittel in alle Bereiche des Innenprofils gelangt und anschließend das Hohlprofil einem Trockenofen zugeführt wird.

6. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß die Temperatur für die Beschichtung des mit dem aktivierbaren Materials (2) versehenen festen Kernmaterials (1) niedriger gewählt ist als die Einbrenntemperatur für die Korrosionsschicht im Trockenofen.

7. Verfahren nach Anspruch 5 oder 6, dadurch gekennzeichnet, daß im Trockenofen infolge der höheren Temperatur eine Reaktion des aktivierbaren Materials (2) ausgelöst wird und durch den sich dabei bildenden Schaum der ursprünglich gezielt hergestellte Hohlraum (3) zwischen dem aktivierbaren Material (2) und dem Außenblech (4) ausgefüllt wird.

Hierzu 2 Seite(n) Zeichnungen

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(58) Publications taken into consideration for assessment of patentability:

DE 1 96 35 734 A1
DE 42 27 393 A1

(54) Hollow section with internal stiffening and process for the production of this hollow section

(57) In hollow sections with internal stiffening, especially for use in car bodies, a corrosion prohibitor should get into all areas, and a hollow stiffness be achieved without any increase in weight and without any increase in cross-section. For this purpose a solid core material is coated with an activatable material and an outer metal sheet is arranged, forming a hollow space which can be produced by the foaming process of the activatable material, the size of the hollow space being predetermined by the arrangement of distance pieces, depending on the application. The solid core material is formed from a foamed or unfoamed metallic material or from a synthetic material reinforced with metal fibres, carbon fibres or glass fibres.

Description

The invention relates to a hollow section with internal stiffening, especially for use in car bodies.

In mechanical engineering and especially in car manufacture, stamped and pre-formed sheet metal profiles are welded together in two sheets. For the hollow sections thus produced, adequate section moduli and bending strength can only be achieved by correspondingly increasing the sheet metal cross-sections or increasing the sheet metal wall thickness. Increasing the cross-sections, especially in the case of motor vehicles, leads to a change in the internal or outer dimensions, and an increase in wall thickness to an undesired weight increase. For stiffening of the hollow sections, there is also the possibility of reinforcing these with ribbed profiles. However, in the case of hollow sections which are to be internally treated against corrosion, ribbed profiles are unsuitable, if a desired protective coating, which is usual in car bodies, is produced by immersion, as the ribbed profiles prevent the corrosion-inhibitor from getting into all areas of the inner profile, or form undesired pockets.

According to DE 42 27 393 A1, a reduction in the hollow space metal's susceptibility to corrosion is achieved within the area of this enclosed space. For this purpose an electrically conductive layer of a sacrificial metal or a foil is applied, this layer being applied via a foaming process of a material enveloping the core, to form a coating on the inner surface of the hollow body. There is no indication in this document of how internal stiffening of hollow bodies suitable for the absorption of forces can be achieved.

The foaming of hollow parts to improve mechanical resistance to deformation is known from DE 196 35 734 A1. It is predominantly a question of seamless or welded tubes which can be shaped as necessary. Special measures to reduce susceptibility to corrosion are not indicated.

The object of the invention is to form a hollow section in such a way that a corrosion inhibitor can get into all areas and a high degree of rigidity can be achieved without any essential increase in weight and without any increase in cross-section.

According to the invention this object is achieved by means of a hollow section with internal stiffening, especially for use in car bodies, in which a core material is coated with activatable material and an outer metal sheet is arranged forming a hollow space, the size of the hollow space being calculated in such a way that it can be completely filled by the foaming process of the activatable material, and the solid core material is formed from a foamed or unfoamed metallic material, or from a synthetic material reinforced with metal fibres, carbon fibres or glass fibres. It is possible to form the solid core material by means of

a hollow section which is resistant to bending. The solid core material is advantageously coated with the activatable material only in parts.

A process according to the invention is characterized in that the hollow section, before the foaming process of the activatable material, is immersed in a bath of corrosion inhibitor, so that the corrosion inhibitor gets into all areas of the internal profile, and the hollow section is then placed in a drying oven.

In one development of the process, the temperature for coating the core material with the activatable material is kept lower than the stoving temperature for the corrosion-inhibitor layer in the drying oven.

In a further development of the invention, in the drying oven, as a result of the higher temperature, a reaction of the activatable material is specifically triggered and the originally specifically produced hollow space between the activatable material and the outer metal sheet is filled with the foam thus formed.

One embodiment of the invention is represented in the drawing and is described in more detail below. It shows:

Fig. 1 a diagrammatic representation of a hollow section before foaming;
Fig. 2, as **Fig. 1**, but after the foaming;
Fig. 3, as **Fig. 1**, but with solid core material in the form of a solid profile body with hollow space and
Fig. 4a to 4d, variants with profiles coated with foamable material.

The solid core material **1** is coated with an activatable material **2**. Forming a hollow space **3**, an outer metal sheet **4** is arranged. The hollow space **3** is completely filled by the foaming process of the activatable material **2**. Depending on the application, the size of the hollow space **3** is predetermined. For this purpose, distance pieces **5** are used, which are arranged according to **Fig. 1** on the inside of the outer metal sheet **4**. According to **Fig. 3** the solid core material **1** is formed by a hollow section **6** which is resistant to bending.

Before the foaming process the hollow section **6** is immersed in a bath of corrosion inhibitor. As the inside of the outer metal sheet **4** is still freely accessible in this condition, the corrosion inhibitor can get into all areas of the inner profile. The coating of the core material **1** is carried out at a temperature which is lower than the stoving temperature for the applied corrosion-inhibitor layer in the drying oven. This higher temperature in the drying oven leads to a reaction of the coating material, triggering the foaming process and the hollow space **3**, which has been specifically formed, is filled with foam.

List of reference designations

1 Core material
2 Activatable material
3 Hollow space
4 Outer metal sheet
5 Distance pieces
6 Hollow section

Patent claims

1. Hollow section with internal stiffening, especially for use in car bodies, in which a core material (1) is coated with activatable material (2) and, forming a hollow space (3) an outer metal sheet (4) is arranged, the size of the hollow space being calculated so that it can be completely filled by the foaming process of the activatable material, and the solid core material (1) is formed from a foamed or unfoamed metallic material, or a synthetic material reinforced with metal fibres, carbon fibres or glass fibres.

2. Hollow section according to Claim 1, characterized in that the solid core material (1) is formed by a hollow section (6).

3. Hollow section according to Claim 2, characterized in that the hollow section (6) is formed resistant to bending.

4. Hollow section according to one of Claims 1 to 3, characterized in that the solid core material (1) is coated with the activatable material (2) only in parts.

5. Process for production of a hollow section with internal stiffening, especially for use in car bodies, according to one of Claims 1 to 4, characterized in that the hollow section, before the foaming process of the activatable material (2) is immersed in a bath of corrosion-inhibitor, so that the corrosion inhibitor gets into all areas of the inner profile and the hollow section is then placed in a drying oven.

6. Process according to Claim 5, characterized in that the temperature for coating the solid core material (1) with the activatable material (2) is kept lower than the stoving temperature for the corrosion-inhibitor layer in the drying oven.

7. Process according to Claim 5 or 6, characterized in that in the drying oven, as a result of the higher temperature, a reaction of the activatable material (2) is triggered and the originally specifically formed hollow space (3) between the activatable material (2) and the outer metal sheet (4) is filled by the foam thus formed,

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accompanied by 2 pages of drawings

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(81) Addition to: 198 12 288.8

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32120 Hiddenhausen, DE

(58) Publications taken into consideration for assessment of patentability:

DE 196 35 734 A1
DE 42 27 393 A1

(54) Hollow section with internal stiffening

(57) In a hollow section with internal stiffening, e.g. for use in car bodies, a core material is coated with an activatable material and an outer metal sheet is arranged, forming a hollow space. The hollow space is completely filled by the foaming process of the activatable material. The core material and the outer material serving used for coating are formed from a stiffening and/or energy-absorbing foam system and/or an acoustic foam.

Description

The invention relates to a hollow section with internal stiffening, especially for use in car bodies, in which a core material is coated with an activatable material and an outer metal sheet is arranged forming a hollow space, the size of the hollow space being calculated so that it can be completely filled by the foaming process of the activatable material, according to Patent DE 198 12 288 C1.

The hollow section according to the basic patent has already proved successful in practice. An even better degree of efficiency can be achieved if, according to the invention, the core material and the outer material used for coating are formed from a stiffening and/or

energy-absorbing foam system and/or an acoustic foam. In one form of the invention the core material is formed from an energy-absorbing material, and the outer material used for coating from a stiffening material and/or an acoustic foam. In a variant of the invention the core material is formed from a stiffening material, and the outer material used for coating from an energy-absorbing material and/or an acoustic foam. It is possible to form the core material from an acoustic foam and the outer material used for coating from a stiffening and/or energy-absorbing material.

Patent Claims

1. Hollow section with internal stiffening, especially for use in car bodies, in which a core material is coated with an activatable material and an outer metal sheet is arranged forming a hollow space, the size of the hollow space being calculated so that it can be completely filled by the foaming process of the activatable material, according to Patent 198 12 288 C1, characterized in that the core material and the outer material used for coating is formed from a stiffening and/or an energy-absorbing foam system and/or an acoustic foam.

2. Hollow section according to Claim 1, characterized in that the core material is formed from an energy-absorbing material, and the outer material used for coating from a stiffening material and/or an acoustic foam.

3. Hollow section according to Claim 1, characterized in that the core material is formed from a stiffening material, and the outer material used for coating from an energy-absorbing material and/or an acoustic foam.

4. Hollow section according to Claim 1, characterized in that the core material is formed from an acoustic foam, and the outer material used for coating from a stiffening material and/or an energy-absorbing material.

The invention relates to a process for the production of a hollow section with internal stiffening as well as a hollow section produced with inner stiffening by the process.

In mechanical engineering and especially in automobile assembly, pressed and pre-fabricated sheet metal sections are welded together as two skins. In the case of the hollow sections created by this it is only possible to achieve satisfactory resistance factors and rigidity when the sheet metal cross-sections are enlarged accordingly or the sheet metal wall strength is increased. Enlarging the cross-sections especially in the case of motorised vehicles leads to a change in internal or external dimensions, and an increase in the wall strength leads to an undesirable extra weight In order to stiffen hollow sections there exists otherwise the possibility of reinforcing these with rib sections. In the case of hollow sections which are to receive anti-corrosion protection from within, rib sections are however unsuitable if a wished-for protective coating as customary for automobile coachwork is produced through an immersion process, since the ribs prevent the anti-corrosion protective medium from reaching into all areas of the inner section or else form unsought-after pockets.

From DE 42 27 393 A1 it is supposed to be possible to achieve a reduction of the susceptibility to corrosion of the metal of a hollow body in the area of this enclosed space.

For this purpose there is introduced, amongst other things, an electrically conductive coating made of a sacrificial metal or from a foil, whereby this coating is made into an application on the inner surface of the hollow body by a foam treatment process of one of the materials enveloping the core. It is not possible to gain any pointer from this document how an internal stiffening in hollow sections to absorb energy is achievable.

Foam treatment of hollow parts for improving mechanical resistance capacity against distorting effects is familiar from DE 196 35 734 A1. In such cases, it is a matter predominantly of seamless or welded tubes which may perhaps become twisted out of shape. Special measures for reducing susceptibility to corrosion are not indicated.

According to US-A-5 194 199 there occurs a foam treatment of the material and thereby the in-filling of prescribed appropriate intervening spaces through an immersion in lacquer. The unavoidable result is that the heated immersion coating material either dries on the walling and then triggers the heat reaction, and then a large part of the immersion coating material or the whole of the immersion coating material would have to be earthed, or activated foam would be sure to displace the immersion coating material, which restricts the forming of the foam because of the then necessary blow pressure, and leads to gaps in the foam and thus to a reduced transfer of the genetic energy. Furthermore there exists the danger that at least a part of the immersion coating material penetrates the foam and leads to unspecified properties in the material bonding. How the immersion coating material itself reacts (cures) remains open.

The invention has as its aim to improve the production of a hollow section with a foam-treated hollow section in such a way that the anti-corrosion protection is increased.

In accordance with the invention, this task is met by a process for producing a hollow section with internal stiffening, especially for use with car bodywork, whereby a solid core material is coated with activatable material and during the formation of a specified hollow space an external metal sheet is arranged, where the hollow space is completely filled in with a foam treatment process of the activatable material and the solid core material is formed from a foam treated or non foam treated metallic material or a substance reinforced synthetically from metal fibres, carbon fibres or glass fibres or by a hollow section, and the section is introduced into an anti-corrosion immersion bath before the foam treatment of the activatable material, and hence the anti-corrosion medium reaches into all the areas of the inner section, and subsequently the hollow section is introduced into a drying oven and in this drying oven a reaction of the activatable material is triggered and thereby the defined given hollow space between the activatable material and the outer metal sheeting is filled in. In the presentation of the process as per the invention the temperature for the coating of the solid core material provided with activatable material is kept lower than the firing temperature of the anti-corrosion coating in the drying oven.

In the case of a hollow section with internal stiffening produced by the process as per the invention, the defined given hollow space between the activatable material and the outer metal sheeting is formed by spacers arranged on to the activatable material. There remains the possibility of forming the hollow section so as to be rigid and to coat the solid core material only in some parts with the activatable material.

In the presentation of the invention the core material and the outer material serving as coating are formed from a stiffening and/or an energy absorbing foam system and/or an acoustic foam. In such a case the core material can be formed from an energy absorbing material and the external material serving as a coating from a stiffening material and/or an acoustic foam. In one variant the core material can be formed from a stiffening material and the external material serving as coating from an energy absorbing material and/or an acoustic foam.With another variant the core material is formed from acoustic foam and the external material serving as coating from a stiffening and/or energy absorbing material.

In accordance with the invention, first the anti-corrosion protective medium is placed in an immersion bath and after the superfluous material has been removed, the reaction of the foam is introduced in the drying oven to follow thereafter. During this there is no interdependence between the reaction temperature of the immersion coating and the temperature of the drying oven. Rather it is possible to select by varying the temperature and running time of the drying oven a setting whereby at first the anti-corrosion protection medium dries and then the reaction of the foam is triggered. By this means the foam can bond intensively with the already dried surface coating.

An embodiment of the invention is represented in the drawing and is described in more detail below. They show:

Fig.1 a schematic representation of a hollow section before foam treatment;

Fig.2 as fig.1, but after the foam treatment

Fig. 3 as fig.1, but with the solid core material in the form of a solid body section with a hollow space and

Figs.4a to 4d variants of sections coated with material capable of being foam treated.

The solid core material 1 is coated with an activated material 2. During formation of a hollow section 3 an external metal sheet 4 is arranged. The hollow space 3 is completely filled in by the foam treatment of the activatable material 2. According to each respective instance of application the size of the hollow space 3 is predetermined. For this purpose spacers 5 are used, which are arranged on to the inner side of the outer metal sheet 4. According to figure 3, the solid core material 1 is formed by rigid hollow section 6.

Before the foam treatment the hollow section 6 is introduced into an anti-corrosion immersion bath. As the inner side of the outer metal sheet 4 is till accessible in this state, the anti-corrosion protective medium can reach into all areas of the inner section. The coating of core material 1 occurs at a temperature that is lower than the firing temperature for the application of the anti-corrosion coating in the drying oven. This higher temperature in the drying oven leads to a reaction of the coating material whereby the foam process is triggered and the intentionally formed hollow space 3 is filled in with foam.

- Reference symbol -

LISTING OF THE REFERENCE SYMBOLS:

1. Core material
2. activatable material
3. hollow space
4. outer metal sheeting
5. spacers
6. hollow section

-Patent claims-

BAWDEN & ASSOCIATES

Patent Claims:

1. Process for the production of a hollow section with internal stiffening, especially for use with automobile bodywork, where a solid core material (1) is coated with an activatable material (2) and during the formation of a defined hollow space (3) an external metal sheet (4) is arranged, whereby the hollow space (3) is completely filled by a foam process of the activatable material (2) and the solid core material (1) is formed from a foam-treated or non-foam-treated metallic material or from a material synthetically reinforced with metallic fibre, carbon fibre or glass fibre or by a hollow section, and the section is introduced into an anti-corrosion immersion bath before the foam treatment of the activatable material (2), and hence the anti-corrosion protection medium reaches into all areas of the inner section and subsequently a reaction of the activatable material (2) is triggered in the drying oven and thus the defined given hollow space (3) between the activatable material 2) and the outer metal sheeting (4) is filled in.

2. Process according to claim 1, characterized in that the temperature for the coating of the solid core material (1) provided with activatable material (2) is kept lower than the firing temperature for the anti-corrosion coating in the drying oven.

3. Hollow section with internal stiffening, produced by the process as per claim 1 or 2, characterized in that the defined given hollow space (3) between the activatable material (2) and the outer metal sheet (4) is formed by spacers (5) arranged on to the activatable material (2).

4. Hollow profile as per claim 3, characterized in that the hollow profile (6) is constructed so as to be rigid.

5. Hollow profile as per claim 3 or 4, characterized in that the solid core material (1) is only coated in parts of its area with activatable material (2).

6. Hollow profile as per claims 3 to 5, characterized in that the core material (1) and the external material serving as the coating is formed from a stiffening and/or an energy absorbing foam system and/or an acoustic foam.

7. Hollow section as per claim 6, characterized in that the core material (1) is formed from an energy absorbing material and the external material serving as the coating from a stiffening material and/or an acoustic foam.

8. Hollow section as per claim 6, characterized in that the core material (1) is formed from a stiffening material and the outer material serving as the coating from an energy absorbing material and/or an acoustic foam.

9. Hollow section as per claim 6, characterized in that the core material (1) is formed from an acoustic foam and the outer material serving as the coating from a stiffening and/or energy absorbing material.